REMARKS

The present amendment is in response to the Office Action dated October 17, 2008. Claims 1-37 and 39-50 are now present in this case. Claims 1, 15, 22, 29, and 41 are amended.

Claims 1-5, 12-15, 21, 22, 29, 35-37, 39-41, and 47-50 stand rejected under 35 U.S.C. § 103(a) as unpatentable by Thevenaz et al.(IEEE Transactions on Image Processing Vol. 7, No. 1, Jan 1998) combined with U.S. Patent No. 6,266,453 B1 to Hibbard. The applicants respectfully traverse this rejection and request reconsideration.

As previously discussed with the Examiner, the present disclosure and claims are based, in part, on the recognition by the inventors that sometimes even a single reregistration process can have an adverse effect on image quality. Further, performing a three-dimensional (3-D) image registration may not be necessary when only a two-dimensional (2-D) registration would suffice. However, a determination of the type of registration process to perform, (i.e., 2-D versus 3-D, or no registration at all) requires an *a priori* estimate of patient motion must be performed.

Thevenaz et al. does not teach or suggest such a preregistration estimate of patient motion. The Office Action cites Thevenaz et al. as disclosing an iterative loop to perform image registration, but recognizes that Thevenaz et al. does not teach or suggest any estimate of patient motion prior to performing a registration process. That is, Thevenaz must perform at least one registration process in an iterative loop even if the images are closely aligned. The Office Action cites Hibbard as disclosing the use of a motion estimation procedure before resampling. The applicants respectfully disagree with the Office Action interpretation of Hibbard and its amenability to combination with Thevenaz in the manner suggested in the Office Action. Hibbard is directed to a completely different process known as image fusion where images acquired using different modalities are combined to bring out the best qualities in each imaging modality. (See column 1, lines 11-25). Hibbard discloses, for example, combining MRI imaging, X-ray imaging, computer tomography imaging, and the like. The alignment of images from different modalities is not image registration as understood by those skilled

in the art and discussed in the present application and in Thevenaz et al. Rather, Hibbard is directed to combining totally dissimilar images in which patient motion is not a factor. In response to previous arguments, the Office Action admits that Hibbard does not even mention patient motion at all, but discusses technical aspects of estimating differences between frames captured by those different imaging modalities. The Office Action also recognizes that the fusion process of Hibbard does not provide adequate resolution for image registration. (See Office Action, page 4). This is because image fusion is a completely different process than image registration. The Office Action asserts that a "comparative difference of images taken at temporally different intervals or times necessarily will involve some aspect of patient motion as it would be impossible to have the exact same positioning or capture at two different periods in time." (See Office Action, page 7). The so-called "patient motion" alleged in the Office Action results from the patient moving from one imaging machine to another. Any so-called "patient motion" in Hibbard results from moving from one medical imaging device to another and there is no suggestion in Hibbard of patient motion that may occur during the actual image acquisition by any individual medical imaging device, as recited in the present claims.

In contrast, patient motion, as described in the pending application, refers to undesirable patient motion that occurs during the acquisition of a series of images when the patient ideally would remain still. This is impossible in Hibbard where the patient is moved from one medical imaging device to another. Thus, patient motion refers to undesirable motion that occurs during the image acquisition process by a particular medical imaging device, such as an MRI. It does not refer to the patient moving from one medical imaging device to another. Hibbard is directed to image fusion and does not even address the concept of patient motion that may occur during the imaging process.

Claim 1 has been amended to recite *inter alia* "prior to any resampling, estimating an amount of patient motion that may have occurred during acquisition of the data by the medical imaging device." Thus, the patient motion referred to herein is not patient motion that occurs because the patient moves from one machine to another, but inadvertent patient motion that occurs during the acquisition of images by a medical

imaging device. The combination of Thevenaz and Hibbard do not teach or suggest any such process. Accordingly, claim 1 is clearly allowable over the combination of Thevenaz and Hibbard.

Claims 2 – 5 and 11- 15 are also allowable in view of the fact that they depend from claim 1, and further in view of the recitation in each of those claims. Specifically, claims 12-15 are directed to techniques for determining whether a 2-D or 3-D registration process will occur based on the estimated patient motion. The Office Action, at page 3, asserts that Thevenaz discloses such technology. The applicants respectfully disagree with that assertion. Thevenaz et al. does state that the algorithm was tested in 2-D and in 3-D, but does not ever discuss the selection of one type of registration over another based on patient motion. The section cited in the Office Action contains no such disclosure. The applicants respectfully request that the Examiner specifically quote passages in Thevenaz that support this assertion.

Claim 15 has been amended in a manner similar to that in claim 1. Specifically, claim 15 recites *inter alia* "prior to any resampling, estimating an amount of patient motion that may have occurred during acquisition of the image data by the medical imaging device." The so-called motion described in the Office Action and ascribed to Hibbard is not motion that occurs during the image acquisition process, but which necessarily occurs when the patient moves from medical imaging device to another. For at least these reasons, claim 15 is allowable over the combination of Thevenaz and Hibbard.

Claim 21 is allowable in view of the fact that it depends from claim 15, and further in view of the recitations within the claim. The Office Action asserts, at page 3, that it is inherent that a method set up to perform a method as recited in claim 15 can be set up to "do nothing in the event that the estimation of motion is less than the correction threshold by a set amount." (See Office Action, page 3). However, the method recited in claim 15 and dependent claim 21 does not "do nothing." Rather, the method recites performing an estimate of patient motion and comparing the estimated amount of patient motion with a correction threshold and, as recited in claim 21, avoiding image resampling if the comparison analysis reveals that the estimate of patient motion is less than the correction threshold by a predetermined amount. Neither

of the references taken alone or in combination suggest such an approach. As discussed above Thevenaz always performs a re-registration process. Thus, nothing in Thevenaz suggests estimating an amount of patient motion and avoiding an image resampling if the estimated patient motion is less than a correction threshold by a predetermined amount as recited in claim 21. The Office Action argues at page 4 that Hibbard discloses the use of a motion estimation procedure prior to resampling and that the image differences in Hibbard "necessarily will involve some aspect of patient motion as it would be impossible to have the exact same positioning ort capture at two difference periods in time." (See Office Action, page 7). Thus, the Office Action appears to argue two contradictory positions. Specifically, the Office Action argues that Hibbard, although it never even mentions patient motion, must correct for inevitable patient motion that occurs between two different imaging modalities and thus makes some estimate of patient motion. Then the Office Action takes a contradictory position that a system would inherently be set up to avoid any resample process if the estimate of motion is below a certain threshold. Hibbard makes no such assertion and the process of avoiding a resampling is not inherent in Hibbard. It is well settled that an inherency rejection "must make clear that the missing descriptive matter is necessarily present in the thing described in the reference and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." (See MPEP § 2112 IV, citing In Re Robertson, 169 F3d 743, 745, 49 SUPQ2d 1949, 1950-51 (Fed.Cir. 1999) emphasis added).

Claim 22 has been amended in a manner similar to that discussed above with respect to claims 1 and 15. Namely, claim 22 recites *inter alia* "prior to any resampling, estimating an amount of patient motion that may have occurred during the acquisition of the image data by the medical imaging device." The Office Action also applies the same rationale in the rejection of claim 21 with respect to claim 22. However, as discussed above with respect to claim 21, claim 22 is not directed to a process that does nothing, but is directed to a process of analysis that may avoid imaging resampling if the estimation of patient motion is below a first correction threshold. There is nothing inherent in the references that suggests such a process.

Accordingly, claim 22 is allowable over the combination of Thevenaz et al. and Hibbard. Claim 50 is also allowable in view of the fact that it depends from claim 22 and further in view of the recitation within claim 50.

Claim 29 is an apparatus claim and recites a processor to "prior to any resampling, estimate an amount of patient motion that may have occurred during acquisition of the image data by the medical imaging device." As discussed above with respect to other independent claims, the combination of references does not suggest any technique by which an estimate of patient motion is performed to measure the patient motion that may have occurred during the imaging process itself. Thevenaz et al. always performs a resampling operation, which is inherent in the iterative process disclosed within the reference. While the process in Thevenaz was tested with 2-D and 3-D registration processes, Thevenaz requires the selection of one process or another (i.e., either 2-D or 3-D) before the iterative loop is initiated. There is nothing in Thevenaz that suggests selecting one process or another (i.e., 2-D or 3-D resampling) based on patient motion. The combination of registration prior to any estimate of patient motion and the *a priori* selection of one registration process or another in Thevenaz teaches away from claim 29 in which a processor selects a first resampling procedure, or a second sampling procedure, or avoids an image resampling altogether based on the relationship between the estimated amount of patient motion and correction threshold. The combination of Thevenaz et al. and Hibbard does not overcome this problem. There is no suggestion in either reference of a process to estimate patient motion and, as a result of an analysis between the estimated amount of patient motion and a correction threshold, perform two alternative resampling procedures or avoiding a resampling procedure. Accordingly, claim 29 is allowable over the combination of Thevenaz and Hibbard. Claims 35-37, 39, and 40 are also allowable in view of the fact that they depend from claim 29 and further in view of the recitations in each of those claims.

Claim 41 is a computer readable medium claim with program instructions that cause a processor to "prior to any resampling procedure, estimate an amount of patient motion that may have occurred during acquisition of the image data by the medical imaging device." As discussed above with respect to other independent claims,

the combination of Thevenaz and Hibbard does not suggest any process by which patient motion during acquisition of the medical image data is estimated. Accordingly, claim 41 is allowable over the combination of Thevenaz and Hibbard for the reasons discussed above with respect to other independent claims. Claims 47-49 are also allowable in view of the fact that they depend from claim 41 and further in view of the recitation in each of those claims.

Claims 6-11, 16-20, 23-28, 30-34, and 42-46 stand rejected under 35 U.S.C. § 103(a) as unpatentable by Thevenaz et al. combined with Hibbard regarding claims 5, 15, 22, 29, and 41, and combined further with a journal article by Hill et al. (Topical Review – Medical Image Registration, *Physics in Medicine and Biology* 46 (2001) R1-R45, June 12, 2000). The applicants respectfully traverse this rejection and request reconsideration.

The inapplicability of Thevenaz et al. and Hibbard has already been described in detail above. While Hill is directed to medical image registration, it should be noted that none of the references,. taken alone or in combination, suggest any process that estimates an amount of patient motion that may have occurred during acquisition of the data by the medical imaging device. Further, none of the references, taken alone or in combination, suggest that a 2-D or 3-D registration be alternatively performed based on the estimated amount of patient motion. In addition, none of the references, taken alone or in combination, suggest the possibility of performing no registration if the estimate of patient motion is below a particular threshold. The fact that Hill provides a registration process with a certain level of accuracy does not overcome the shortcoming in Hill which does not suggest that patient motion is estimated *a priori* and that a particular form of resampling (or no resampling at all) is selected based on the amount of patient motion. Accordingly, claims 6-11, 16-20, 23-28, 30-34, and 42-46 are allowable over the combination of references.

In view of the above amendments and remarks, reconsideration of the subject application and its allowance are kindly requested. The applicants have made a good faith effort to place all claims in condition for allowance. If questions remain regarding the present application, the Examiner is invited to contact the undersigned at (206) 757-8029.

Respectfully submitted,

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